APPLYING ENGINEERING PRINCIPLES

Editor's Note: This article was taken from a summer-work report submitted to the Department of Industrial Engineering by Stephen Wargo.

FREDERICK W. TAYLOR, often referred to as the father of Industrial Engineering, performed many interesting experiments on workmen. The most familiar one is used frequently as an example in the department of Industrial Engineering. This particular experiment took place while Taylor was working for a company which employed a gang of men whose job was to carry pig iron from one place to another. Each man picked up a pig from a pile, walked up a plank, and placed it in a railroad car. On the average each man was loading twelve and one-half long tons per day.

Taylor studied the job and learned that if a man were given the proper training he could increase his output to forty-eight long tons per day, an increase of almost 400 per cent. To demand this from the laborers or even suggest it to them would have been the worst possible solution. Taylor, realizing this, approached the problem very scientifically. He first studied the habits, homelife, and general attitude of every man in the gang. By process of elimination he chose a man named Schmidt with whom to perform his experiment. Schmidt was a hard worker, he hurried back and forth to work every day, he was building his own home. It must be understood, however, that Schmidt did not average anymore output per day than did the other workers. One day Taylor took Schmidt aside and spoke to him, he asked him how he would like to have his wages increased from $1.15 to $1.85 per day. Schmidt, of course, agreed but Taylor cautioned him that he must work only when told to, as fast as he was told to, and must rest when told to do so.

The following day Schmidt reported to Taylor who had him work in this manner: Schmidt worked hard and fast for a definite short time and then sat down and relaxed completely for five minutes. This procedure was repeated throughout the entire day with Taylor carefully supervising. Taylor had learned that during Schmidt's ten hour day it would be advisable to actually work him no more than 42 per cent of the time. After several days Schmidt had actually increased his output to 48 long tons and went home after work no more tired than he had been previously when his output was only twelve and one-half long tons per day. This story is a wonderful example of the progress and savings which can be brought about by systemized working and the application of time study. The application is by no means limited to handling pig iron or even to industrial work. Last summer I realied this fact while I was working on a farm.

The first place in which I had an opportunity to use time study was in a corn field. I was somewhat doubtful about attempting anything because I was working with horsepower, not man power. On the average I was able to cultivate two and one-half acres daily. I worked the horse until he was tired and then gave him a long rest, usually about half an hour. The two and one-half acres was approximately the same

amount plowed per day by other farmers in the vicinity. Trying to find a method whereby I could increase my acreage, I though of Schmidt, the rests he was given, the speed at which he had to work, and the way he worked. The next morning I harnessed my horse and applied a system in an attempt to get more work. After every five rows I gave the horse a rest of five minutes; during the working time I made the horse step along at a good rate. The preceding day I had given the horse a half hour rest after about twenty rows. I cut the rest time from thirty to twenty minutes per cycle, thereby saving thirty-three per cent of the rest time. I was quite surprised to note that the horse was no more tired than he had been on the previous day. At the end of the day I had gotten three and one-half acres plowed. This proved to me that by giving frequent short rests rather than infrequent long ones, much more efficiency can be obtained.

Another experiment which I tried was worked out while putting in a line of fence posts. These posts, made of heavy white oak had to be put in the ground every two and one-half feet. Working by myself, I was able to set twenty-one posts per day. That is, I dug the holes, checked to see that they were in line, placed the posts in the holes, and tamped them solidly. However, I thought that if two men worked on the job they would probably be able to accomplish more than twice as much as I had been able to domyself. The next day I tried having another man work with me. I dug the holes and checked and lined up the posts, he put the posts in the holes and tamped them. At the end of the day we had set 68 posts, a total of 34 each. This figure showed an efficiency increase of 62 per cent. This result proved to me that it is possible to greatly increase the efficiency of the job of setting up posts if two men, instead of one, work at the job. This fact will hold true, of course, only if the two men are kept busy all the time, that is, only if each man's task requires the same amount of time for completion.

I think that the reason we were able to increase our efficiency to such an extent is because of following the law of specialization of the job, "Subdividing the work so that one or a very few manual or mental operations can be assigned to a worker improves the quality and increases the quantity of the work."[1]

When one man is working he must first pick up the post-digger, dig the hole, put the post-digger down, go to the post, pick it up, place it in the hole, line it up, and then tamp it. He then must measure off to the next position and repeat the process. With two men working, one of the several time saving operations is that effected when one man keeps the post-digger in his hand as he measures off to the next position and from there can line up the post instead of having to walk back and forth as must be done when only one man is on the job. This helps to prove the assertion that in order to get the most work from an individual, all useless and unnecessary motions must be eliminated. These two illustrations of time saving methods are just a few of the many ways in which engineering principles may be used in everyday life if only we apply our knowledge to the best advantage.
